



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/737,205	12/15/2003	Trishul Chilimbi	3382-66145	7671

26119 7590 02/26/2007
KLARQUIST SPARKMAN LLP
121 S.W. SALMON STREET
SUITE 1600
PORTLAND, OR 97204

EXAMINER

FRANCIS, MARK P

ART UNIT	PAPER NUMBER
----------	--------------

2193

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	02/26/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/737,205	CHILIMBI ET AL.	
	Examiner	Art Unit	
	Mark P. Francis	2193	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 15 December 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-52 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-52 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 15 December 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Mark P. Francis
SUPERVISORY PATENT EXAMINER
12/15/03

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date <u>12/15/03; 11/16/05; 04/07/06; 05/26/06</u> | <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. This action is responsive to the application filed on December 15, 2003.
2. Claims 1-52 have been examined.

Oath/Declaration

3. The Office acknowledges receipt of a properly signed oath/declaration filed December 15, 2003.

Priority Date

4. The Office acknowledges the priority date of April 25, 2003 for this application.

Claim Rejections - 35 USC § 101

5. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

6. Claims 1-43 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.

Regarding claims 1,17 and 29,

In this instance, the language of the claim raises a question as to whether the claim is directed merely to an abstract idea that is not tied to an environment or machine which would result in a practical application that would produce a useful, concrete, and tangible result to form the basis of statutory subject matter under 35 USC 101.

Art Unit: 2193

According to the 101 Interim Guidelines, The tangible requirement does not necessarily mean that a claim must either be tied to a particular machine or apparatus or must operate to change articles or materials to a different state or thing. However, the tangible requirement does require that the claim must recite more than a § 101 judicial exception, in that the process claim must set forth a practical application of that § 101 judicial exception to produce a real-world result. Benson, 409 U.S. at 71-72, 175 USPQ at 676-77 (invention ineligible because had "no substantial practical application."). "[An application of a law of nature or mathematical formula to a ... process may well be deserving of patent protection." Diehr, 450 U.S. at 187, 209 USPQ at 8 (emphasis added); see also 21 Corning, 56 U.S. (15 How.) at 268, 14 L.Ed. 683 ("It is for the discovery or invention of some practical method or means of producing a beneficial result or effect, that a patent is granted . . ."). In other words, the opposite meaning of "tangible" is "abstract."

Applicant defines a method for enhancing cache performance by receiving a data reference profile, detecting one or more hot data streams, and analyzing to determine a coallocation solution for allocations in heap memory. All of these steps can be implemented using software means only and does not produce a tangible result of a practical application. Thus, the claims are Non-Statutory.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

Art Unit: 2193

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

8. Claims 1-52 are rejected under 35 U.S.C. 102(e) as being anticipated by Breslau.
(U.S. Pub 2002/0133539)

Independent claims

With respect to claim 1, Breslau discloses a computer-implemented method of enhancing cache performance, (Col 1:0013, "...managing the object at runtime...", Col 3:0032, "...to increase the processing capacity...") the method comprising: receiving a temporal data reference profile; (Col 1:0015, "...preserving the state of the object during the migrating...") detecting one or more hot data streams in the temporal data reference profile; (Col 3:0036, "...a performance monitor may detect...") and analyzing the one or more hot data streams and the temporal data reference profile to determine a coallocation solution for allocations in heap memory. (Col 3:0032-0035, "...the single instance, object B is split...", Col 5:0053-0055, "...an object that has a split status...")

Art Unit: 2193

With respect to claim 17, Breslau discloses a computer-readable medium(e.g. See Fig. 1 elements 15 and 19 and related text) storing computer-executable instructions for causing a computer system programmed thereby to perform a method of enhancing cache performance, (Col 1:0013, "...managing the object at runtime...", Col 3:0032, "...to increase the processing capacity...") the method comprising: receiving a profile of object field accesses; (Col 1:0015, "...preserving the state of the object during the migrating...")

and determining a coallocation solution based at least in part upon the profile, (Col 0032, "...is split...")wherein the coallocation solution increases locality of object fields(Col 5:0051-0054, "...the object identifier...is associated with a SIP corresponding to a Split Routing Table...") in a layout in memory to improve cache performance. (Col 3:0032-0035, "...the single instance, object B is split...",Col 5:0053-0055, "...an object that has a split status...")

With respect to claim 29, Breslau discloses a computer-readable medium storing computer-executable instructions for causing a computer system (Col 2:0028, "...a single execution environment computer system...") programmed thereby to perform a method of enhancing cache performance, (Col 1:0013, "...managing the object at runtime...", Col 3:0032, "...to increase the processing capacity...") the method comprising:
receiving a comprehensive temporal data access profile for a computer program; (Col 1:0015, "...preserving the state of the object during the migrating...")

Art Unit: 2193.

detecting one or more data access patterns in the temporal data access profile, each of the one or more data access patterns including plural data accesses and occurring one or more times in the temporal data access profile; (Col 3:0036, "...a performance monitor may detect...")

and analyzing the one or more data access patterns and the temporal data access profile to determine a coallocation solution for allocations in memory. (Col 3:0032-0035, "...the single instance, object B is split...", Col 5:0053-0055, "...an object that has a split status...")

With respect to claim 44, Breslau discloses a system for coallocating data in memory to improve cache performance, (Col 1:0013, "...managing the object at runtime...", Col 3:0032, "...to increase the processing capacity...") the system comprising:

an analysis module for determining a coallocation solution based at least in part upon a temporal data access profile of a computer program; (Col 1:0015, "...preserving the state of the object during the migrating...")

an instrumentation module for automating alteration of the computer program based at least in part upon the coallocation solution; (Col 4:0041-0044, "...removal of the object from memory...")

and an enforcement module for automatically enforcing the coallocation solution during execution of the altered computer program. (Col 3:0036-0038, "...and accordingly generates a "split" request therefor...")

Dependent claims

With respect to claims 2 and 30, the rejections of claims 1 and 29 are incorporated respectively and further Breslau discloses that the temporal data access profile traces accesses of objects, and wherein the one or more data access patterns are for object accesses. (Col 4:0041-0044, "...Regarding object accesses...")

With respect to claims 3,18 and 31, the rejections of claims 1,17 and 29 are incorporated respectively and further Breslau discloses that the temporal data reference profile traces accesses of object fields, and wherein the one or more hot data streams are for object field accesses. (Col 3:0037-0038, "...Access to the object...")

With respect to claim 4, the rejection of claim 1 is incorporated and further Breslau discloses that the coallocation solution includes one or more of field reordering, (Col 5:0051-0054, "...the identification, tracking, and instantiation...")object splitting, and object merging. (Col 3:0035-0037, "...merged status...to a split status...")

With respect to claim 5, the rejection of claim 1 is incorporated and further Breslau discloses further comprising: altering a computer program to implement the coallocation solution. (Col 3:0035-0037, "...merged status...to a split status...")

With respect to claim 6, the rejection of claim 5 is incorporated and further Breslau

Art Unit: 2193

discloses that the altering comprises binary rewriting of a computer program. (Col 4:0041-0044, "...removal of the object from memory...")

With respect to claim 7, the rejection of claim 5 is incorporated and further Breslau discloses that the altering comprises rewriting of part of source code of the computer program under control of a programmer. (Col 4:0041-0044, "...removal of the object from memory...")

With respect to claim 8, the rejection of claim 5 is incorporated and further Breslau discloses that the altering comprises adjusting executable code for the computer program at compile time. (Col 5:0055-0056, "...is performed at run time...")

With respect to claim 9, the rejection of claim 5 is incorporated and further Breslau discloses further comprising: after the altering, executing the computer program, wherein run time support software enforces the coallocation solution. (Col 3:0036-0038, "...and accordingly generates a "split" request therefor...")

With respect to claim 10, the rejection of claim 1 is incorporated and further Breslau discloses a computer-readable medium storing the computer program altered according to the method of claim 5. (e.g See Fig. 1 and related text)

With respect to claim 11, the rejection of claim 1 is incorporated and further Breslau

Art Unit: 2193

discloses that the coallocation solution is based at least in part on results of weighted set packing analysis for plural coallocation sets. (Col 3:0036-0038, "...and accordingly generates a "split" request therefor...")

With respect to claim 12, the rejection of claim 11 is incorporated and further Breslau discloses that each of the plural coallocation sets comprises a set of allocation sites for objects in one of the hot data streams. (Col 4:0039-0041, "...object routing information contained within the ORB...")

With respect to claim 13, the rejection of claim 11 is incorporated and further Breslau discloses that each of the plural coallocation sets comprises a set of allocation sites for object fields in one of the hot data streams. (Col 4:0039-0041, "...object routing information contained within the ORB...")

With respect to claim 14, the rejection of claim 1 is incorporated and further Breslau discloses that the analyzing comprises: computing a heat value for each of the one or more hot data streams; and computing a weight value for each of the one or more hot data streams. (Col 3:0032-0035, "...the single instance, object B is split...", Col 5:0053-0055, "...an object that has a split status...")

With respect to claim 15, the rejection of claim 14 is incorporated and further Breslau discloses that the analyzing further comprises: avoiding double counting for sub-sets

Art Unit: 2193

among the one or more hot data streams. (Col 4:0041-0044, "...removal of the object from memory...")

With respect to claim 16, the rejection of claim 1 is incorporated and further Breslau discloses a computer-readable medium storing computer-executable instructions for causing a computer system programmed thereby to perform the method of claim 1. (Col 2:0016-0017, "...operates in an object-oriented computer system...")

With respect to claim 19, the rejection of claim 17 is incorporated and further Breslau discloses that the method further comprises: detecting one or more hot data streams in the profile. (Col 3:0036, "...a performance monitor may detect...")

With respect to claim 20, the rejection of claim 17 is incorporated and further Breslau discloses that the coallocation solution includes object restructuring in a computer program, the method further comprising: executing the computer program after the object restructuring, wherein the coallocation solution guides object-level allocations in heap memory. (Col 4:0049-0051, "...Each entry in the table...")

With respect to claim 21, the rejection of claim 20 is incorporated and further Breslau discloses that the object restructuring includes field reordering. (Col 5:0051-0054, "...object B are facilitated...")

Art Unit: 2193

With respect to claim 22, the rejection of claim 20 is incorporated and further Breslau discloses that the object restructuring includes object splitting. (Col 1:0035-0038, "...from a merged status...to a split status...")

With respect to claim 23, the rejection of claim 20 is incorporated and further Breslau discloses that the object restructuring includes object merging. (Col 4:0046-0049, "...object being merged...")

With respect to claim 24, the rejection of claim 17 is incorporated and further Breslau discloses that the coallocation solution includes object restructuring in a computer program, the method further comprising: performing the object restructuring at design time. (Col 4:0041-0044, "...object...execution environment...")

With respect to claim 25, the rejection of claim 24 is incorporated and further Breslau discloses a computer-readable medium storing the computer program altered according to the method of claim 24. (Col 2:0028-0031, "...computer usable media...")

With respect to claim 26, the rejection of claim 17 is incorporated and further Breslau discloses that the coallocation solution includes object restructuring in a computer program, the method further comprising: performing the object restructuring at run time. (Col 4:0041-0045, "...removal of the object...execution environment...")

Art Unit: 2193

With respect to claim 27, the rejection of claim 17 is incorporated and further Breslau discloses that the method further comprises: executing a computer program, wherein the coallocation solution guides field-level allocations in heap memory. (Col 3:0035-0037, "...merged status...to a split status...")

With respect to claim 28, the rejection of claim 17 is incorporated and further Breslau discloses that the determining comprises: computing a weighted set packing for one or more field coallocation sets; and selecting the coallocation solution. (Col 3:0032-0035, "...the single instance, object B is split...", Col 5:0053-0055, "...an object that has a split status...")

With respect to claim 32, the rejection of claim 29 is incorporated and further Breslau discloses that the coallocation solution includes field reordering. (Col 5:0051-0054, "...object B are facilitated...")

With respect to claim 33, the rejection of claim 29 is incorporated and further Breslau discloses that the coallocation solution includes object splitting. (Col 5:0052-0055, "...an object that has a split status,...")

With respect to claim 34, the rejection of claim 29 is incorporated and further Breslau discloses that the coallocation solution includes object merging. (Col 4:0039-0042, "...merged"...")

With respect to claim 35, the rejection of claim 29 is incorporated and further Breslau discloses that the coallocation solution is for guiding memory placement decisions for heap objects in subsequent execution of the computer program. (Col 3:0037-0038, "...Access to the object...")

With respect to claim 36, the rejection of claim 29 is incorporated and further Breslau discloses that the method further comprises altering the computer program to implement the coallocation solution. (Col 3:0035-0037, "...merged status...to a split status...")

With respect to claim 37, the rejection of claim 36 is incorporated and further Breslau discloses that the altering comprises binary rewriting of the computer program. (Col 4:0041-0044, "...removal of the object from memory...")

With respect to claim 38, the rejection of claim 36 is incorporated and further Breslau discloses that the altering comprises rewriting of part of source code of the computer program under control of a programmer. (Col 4:0041-0044, "...removal of the object from memory...")

With respect to claim 39, the rejection of claim 36 is incorporated and further Breslau discloses that the altering comprises adjusting executable code for the computer

Art Unit: 2193

program at compile time. (Col 4:0041-0045, "...removal of the object...execution environment...")

With respect to claim 40, the rejection of claim 36 is incorporated and further Breslau discloses that the method further comprises: after the altering, executing the computer program, wherein run time support software enforces the coallocation solution. (Col 3:0036-0038, "...and accordingly generates a "split" request therefor...")

With respect to claim 41, the rejection of claim 36 is incorporated and further Breslau discloses a computer-readable medium storing the computer program altered according to the method of claim 36. (Col 4:0043-0046, "...another program or object executing...")

With respect to claim 42, the rejection of claim 29 is incorporated and further Breslau discloses that the temporal data access profile includes a series of data accesses spanning execution of the computer program during a profiling run. (Col 4:0040-0044, "...Regarding object access,...")

With respect to claim 43, the rejection of claim 29 is incorporated and further Breslau discloses that the coallocation solution is for guiding memory placement decisions for heap objects in subsequent execution of the computer program, (Col 4:0049-0051, "...ORB Routing Table tracks objects...") the method further comprising:

Art Unit: 2193

coallocating a first set of heap objects in a first heap memory arena to improve locality for accesses of the first set of heap objects; (Col 4:0050-0051, "...is represented in the ORB Routing table...")

coallocating a second set of heap objects in a second heap memory arena to improve locality for accesses of the second set of heap objects; (Col 5:0051-0054, "...the object identifier...is associated with a SIP corresponding...")

and allocating other heap objects in a default heap memory arena. (Col 5:0051-0054, "...the object identifier...is associated with a SIP corresponding...")

With respect to claim 45, the rejection of claim 44 is incorporated and further Breslau discloses further comprising: a profiling module for generating the temporal data access profile. (Col 3:0036, "...a performance monitor may detect...")

With respect to claim 46, the rejection of claim 44 is incorporated and further Breslau discloses that the instrumentation module comprises a binary re-writer. (Col 4:0041-0044, "...removal of the object from memory...")

With respect to claim 47, the rejection of claim 44 is incorporated and further Breslau discloses that the instrumentation module automates changing of heap allocation requests to heap coallocation requests. (Col 5:0053-0055, "...When the ORB receives an invocation request for an object...")

Art Unit: 2193

With respect to claim 48, the rejection of claim 44 is incorporated and further Breslau discloses that the enforcement module comprises a library for run time support of heap coallocation requests. (Col 5:0053, "...within the Split Routing Table...")

With respect to claim 49, the rejection of claim 44 is incorporated and further Breslau discloses further comprising a plurality of memory arenas in which to implement the coallocation solution. (Col 5:0053-0056, "...the list of instances within the Split Routing Table...")

With respect to claim 50, the rejection of claim 44 is incorporated and further Breslau discloses that the analysis module determines a heat value for each of one or more hot data streams in the temporal data access profile. (Col 5:0053-0055, "...The heuristic used to make such a decision...")

With respect to claim 51, the rejection of claim 44 is incorporated and further Breslau discloses that the temporal data access profile traces object field accesses. (Col 4:0041-0044, "...Regarding object accesses...")

With respect to claim 52, the rejection of claim 44 is incorporated and further Breslau discloses that the temporal data access profile traces object accesses. (Col 4:0041-0044, "...Regarding object accesses...")

Art Unit: 2193

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mark P. Francis whose telephone number is (571)272-7956. The examiner can normally be reached on Mon-Fri 8:00-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Meng-Ai T. An can be reached on (571)272-3756. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.


MENG-AI T. AN
SUPERVISORY PATENT EXAMINER
ELECTRONIC BUSINESS CENTER